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AUTHOR	Kamii, Constance
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ABSTRACT

Specific instruction refers to the teacher's knowing (a) what to teach and when, (b) what not to teach and why, and (c) when to let the preoperational child be "wrong." This paper is in agreement with Bereiter's criticism of Kohlberg's conclusion against specific instruction but suggests that Bereiter's argument should be developed into a guide useful for actual teaching. A detailed discussion follows of specific instruction as it is related to Piaget's three areas of knowledge, (social, physical, and logico-mathematical) to development, and to theories of learning. It is argued that instruction can be more specific in some ways, as in the teaching of social knowledge, and in the structuring of cognitive processes that will eventually result in logical thinking. Piagetian principles of learning seem to indicate that teaching must take into account the preoperational child's total cognitive structure even when the content and strategy of teaching are specific. [Not available in hard copy due to marginal legibility of original document.] (Author/NH)

PIAGET'S THEORY AND SPECIFIC INSTRUCTION: A RESPONSE TO BEREITER AND KOHLBERG[1]

Constance Kamii

Ypsilanti Public Schools

Ypsilanti, Michigan 48197

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This paper draws pedagogical implications from Piaget's theory in the light of Bereiter's critical response to Kohlberg's view against specific instruction. It argues that instruction can be more specific in some ways than Kohlberg suggested, e.g., in the teaching of social knowledge and in the structuring of cognitive processes that will eventually result in logical thinking. It shows the relevance of Piaget's theory to early childhood education and argues that specific instruction should take place within a developmental context and within the framework of a broad theory of knowledge.

In the preceding article, Bereiter responded critically to Kohlberg's conclusion against specific instruction (Kohlberg, 1968). Although Bereiter did not make a convincing case in support of specific instruction, his article did have the effect of causing me to re-read Kohlberg's paper in a new light. This re-examination led to the conclusion that the educational implications Kohlberg drew from Piaget's theory were too general. This paper is written to present some other implications that can be drawn from Piaget's theory.

I shall first attempt to indicate that the three areas of knowledge delineated by Piaget (social, physical, and logico-mathematical knowledge) suggest where instruction should be specific and where it should not be. The term "specific instruction" will then be interpreted to refer to the teacher's knowing specifically when to teach something and when not to teach it. The final part of the paper will present other educational implications that can be drawn from Piaget's theory with regard to the context within which I believe specific instruction must take place.

Before going on to the main part of the paper, I would like to point out that both Bereiter and Kohlberg did not push their analyses far enough to be useful to the curriculum builder. Bereiter did not make a convincing case partly because he did not address himself to the real issue. The question Kohlberg raised was not whether or not instruction should be specific, but how early education could be conducted to be of long-term benefit. Having shown that Kohlberg's statements could be questioned, Bereiter did not attempt to specify any principle to guide the policy maker in deciding what to teach at what age so as to produce long-term gains. It is hoped that he will advance his arguments further toward a general theory of instruction that will be broad enough to generate a curriculum for early childhood education.

I am in agreement with Kohlberg's view that the Piagetian approach does not give rise to great optimism about the extent to which preschool education can compensate for the lack of "massive general types of experience". However, I am of the opinion that cognitive stages are more modifiable than Kohlberg seems to believe. Kohlberg gave an overly pessimistic outlook and said almost nothing about how a theory of instruction could be based on Piaget's theory. The only pedagogical principles he gave are the following:

1. Intellectual development can be accelerated by "employing cognitive conflict, match, and sequential ordering of experience" and "active and self-selective forms of cognitive stimulation" (p. 1056).
2. ". . . Piaget and his followers have systematically studied the development of preschool children's play, their conversations with one another, their conception of life, of death, of reality, of sexual identity, of good and evil. The implications of these and other themes for the broader definition of preschool objectives are taken up elsewhere (Kohlberg & Lesser, in preparation)" (pp. 1056-57).
3. ". . . limited specific training experiences cannot replace the massive general types of experience accruing with age" (pp. 1029-30).

These principles hardly show even to the most sympathetic reader how Piaget's theory can be applied to actual teaching. Kohlberg intended to describe the pedagogical principles elsewhere, but it is easy to see how the few points he did sketch invited the criticism that his article showed a "theoretical dead end". I shall attempt to sketch below a few directions in which this epistemological theory can be developed into a theory of instruction.

Specific Instruction and the Three Areas of Knowledge

Piaget delineated three areas of knowledge according to their respective sources. They are social knowledge, which comes from people; physical knowledge, which comes from physical phenomena; and logico-mathematical knowledge, which is structured from the internal cognitive structure that the child has already built. Each will be described below in order to show how this framework enables the teacher to know the kind of content that can be taught as specifics.

The ultimate source of social knowledge is people, and the child can acquire it only from people. Some examples are

1. All the names of objects, animals, people, and ideas, both in spoken and written forms.
2. Saucers go under cups, and not under pencils.
3. Tables are not to stand or sit on.
4. Girls wear skirts, and boys wear pants.
5. We eat three meals a day.
6. My telephone number is (123)-456-7890.
7. December 25 is Christmas Day.
8. Washington, D. C., is the capital of the United States.

It can be seen from the above examples that the nature of social knowledge is rather arbitrary, and that specific feed-back from people is essential for the child to build social knowledge.

The ultimate source of "truth" in physical knowledge is physical phenomena. The child finds out about most physical phenomena by acting on objects and observing the objects' reactions. Some examples are

1. This cup will go down (not up) if I let go of it, and it will break because it is made of porcelain.
2. Balls bounce when they are dropped on the floor, but cups do not.
3. Pennies sink in water.
4. Wheels roll, but blocks do not.
5. If there are 5 marbles on one side of the balance, there will have to be an equal number on the other side to make it balance.
6. The light will go off when I turn off the switch.
7. Plants die if they are not watered.

While social and physical knowledge is built from sources that are external to the child, logico-mathematical knowledge is structured from the internal consistency of the system that the child has already built. Some examples are

1. If I take out 10 cups and 10 saucers, there will be as many cups as saucers even if their spatial arrangement is changed.
2. If A is bigger than B, and B is bigger than C, A is bigger than C.
3. There are more animals in the world than dogs.
4. If all men are mortal, and Socrates was a man, Socrates was mortal.

In the logico-mathematical realm, the child's knowledge is based on his own reasoning rather than on external sources. In the above examples,

he "knows" that there *have to be* as many cups as saucers without re-establishing the one-to-one correspondence. He "knows" that A *has to be* bigger than C without empirically comparing the two. He "knows" that there *have to be* more animals in the world than dogs without actually counting them. He "knows" that Socrates *must have died* without checking the empirical fact.

It can be seen from the above distinction that in social and physical knowledge learning is both specific and based on feedback from external sources. These are the areas in which instruction can and should be specific. If the child is wrong in social knowledge, he can simply be told the social rule (e.g., Christmas is not December 24). If he thinks that a ball will break when it is dropped, he can find out the truth by dropping the object and studying the regularity of the object's reaction. The child is not made unsure of himself when he is flatly contradicted in social and physical knowledge. In the logico-mathematical realm, however, teaching is more delicate. Even if a three-year-old could somehow be taught the conservation of number, such teaching is likely to make him unsure of his beliefs unless he can anchor the learning in the total system of how he thinks.

The statement that instruction can be specific in social and physical knowledge does not imply that the child can learn specific facts without a logical structure. In fact, according to Piaget, every concept is related to every other concept that the child has acquired. Instruction must, therefore, be anchored in the total system of how the child thinks so that the development of one concept will affect the development of the entire network in an integrated way. For example, knowing that "girls wear skirts" or that "porcelain broke today, yesterday, and the day before yesterday" requires the ability to classify and to structure the regularity of events.

over time. Piaget's theory thus permits the analysis of knowledge into three major areas and suggests how the mutual inter-dependence among the three might be used to strengthen each other. Through the teaching of social and physical knowledge, it is often possible to facilitate the organization of logico-mathematical structures. The details of a preschool curriculum based on this framework are being developed, and are outlined in Kamii and Radin (1970, in press), Sonquist, Kamii, and Derman (1970, in press), and Kamii (in press).

Specific Instruction in a Developmental Context

Piaget's theory is the only one in existence that demonstrates the continuity of cognitive development from birth to adolescence. It shows how the most abstract hypothetico-deductive thinking of the adult evolves out of the infant's sensory-motor intelligence. The educational implication of this continuity is that the objectives of preschool education should be not only the mastery of specific content and processes but also the consolidation of previous acquisitions and the preparation of abilities that will take two, three, or more years to appear. The term "specific instruction" in this developmental context changes its meaning to refer to the teacher's knowing specifically why she teaches (or does not teach) certain things during the preschool years.

Inhelder has conducted learning experiments in Geneva to find out, among other things, how logical structures are acquired and to what extent operations can be taught. The conclusion stated in Inhelder, Bovet, and Sinclair (1967) is that learning is possible within the limits imposed by the child's developmental level at the time teaching

is initiated. The early pre-operational child progresses only to a slightly more advanced pre-operational level. The child who is at an intermediary pre-operational level to begin with usually reaches the threshold of operations with the same general method of instruction. The child who is very close to the operational level reaches it very quickly. In other words, children progress from one stage to another within the pre-operational period, i.e., from one stage of being "wrong" to another stage of being "wrong", before they become able to reason logically like adults.

The implication of the above conclusion is that specific instruction must be specific from the learner's point of view, rather than from the adult's point of view. As can be seen in the teaching experiment described in Sinclair and Kamii (1970, in press), the pre-operational child learns in ways that adults do not expect, and specific instruction must be careful not to impose adult logic, thereby making the child skip the intermediary stages that he needs to go through.

The administration of Piagetian tasks to the children taught by Engelmann illustrates what pre-operational children learn when specific instruction imposes adult logic (Kamii & Derman, in press). In this experiment, Engelmann taught the concept of specific gravity to six-year-old children to demonstrate that formal operations could be taught to pre-operational children. The children were found unmistakably to have learned to "explain" that certain objects float on water "because they are <u>lighter</u> than a piece of water the same size," and that other objects sink "because they are <u>heavier</u> than a piece of water the same size." However, when the questions were changed to non-verbal tasks, it was found that the children were thinking just like any other pre-operational children. For example, they were asked to sort a number of objects into "things that you think

will float" and "things that you think will sink." Typically, they put large and/or heavy objects in the category of "sink", and small and/or light objects in the category of "float". For example, some children put the large candle in the "sink" pile, and the tiny birthday candle in the "float" pile.

It was concluded, therefore, that the children had not really learned the concept of specific gravity. In fact, the imposition of adult logic may even have stifled their ability to think. When faced with a hard question, they seemed to mentally search through their memory to find any rule that might fit the facts. Thus, when a needle was predicted to float, but was found to sink, the children simply changed their "explanation" from "it's lighter than a piece of water the same size" to "it's heavier than a piece of water the same size." They did not show any sign of curiosity as to why <u>some</u> small objects sink and why <u>some</u> large objects float.

Inhelder and Piaget believe that, for the solid structuring of the concept of specific gravity, children need to have the following pre-requisites: (a) The conservation of substance, weight, and volume, (b) class inclusion, and (c) the seriation of sizes and weights. In the Piagetian approach to teaching, children thus have to be given the time and freedom they need to build the pre-requisite structures, to figure out their own strategy, to mobilize their entire cognitive organization, and to go through the sub-stages they need to go through in order to build a solid foundation for future learning. "Specific instruction" in a Piagetian sense thus takes on the meaning that the teacher has to know (a) what to teach and when, (b) what not to teach and why, and (c) when to let the pre-operational child be "wrong". Examples of each situation are given below.

A. What to teach and when

A distinction must be made between teaching for the attainment of operations and for the preparation of their eventual attainment. Bereiter and Kohlberg discussed teaching only in the first sense, particularly with regard to whether or not conservation can be taught. I believe that the better strategy for teaching the pre-operational child is to put the emphasis on the preparation of operations.

Piaget's theory stresses the process of reasoning which enables the child to reach the correct conclusion. If the process becomes better structured and more mobile, the child will inevitably achieve the operations. "Preparing the child for operations" thus places the accent on general and specific instruction that aims at the underlying process rather than the final product.

Examples of preparing the child for the acquisition of number concepts can be found in Kamii (1969, in press) and Ezell, Hammerman, and Morse (1969). As can be seen in these papers, we believe that the teaching of conservation of number as such should be avoided, and that educational efforts should focus on the processes that underlie conservation, i.e., (a) making groups and comparing grossly different groups, (b) arranging, dis-arranging, and re-arranging objects, (c) linear ordering, (d) establishing and re-establishing equivalence with provoked correspondence, (e) temporal correspondence, (f) "renversabilité", etc. Teaching the underlying processes entails refraining from external reinforcement to let the child figure out for himself whether or not his prediction was correct. Social reinforcement and the giving of rules based on empirical generalization are efficient only in the short run.

This statement will be further elaborated in connection with the Piagetian notion of "learning".

B. What not to teach and why

It is evident from the above discussion that, in my opinion, the conservation of number should not be taught explicitly. Below are two other examples of things not to teach according to the implications that I draw from Piaget's theory.

1. Teaching the relationships among seconds, minutes, hours, days, weeks, months, and years to children who do not have class inclusion.
2. Teaching to write letters to children whose representational space is not structured enough to even copy squares and triangles (Piaget & Inhelder, 1967).

C. When to let the pre-operational child be "wrong"

As it was stated above, both in teaching experiments and in nature, pre-operational children progress from one stage to another within the pre-operational way of thinking before they achieve concrete operations. It becomes clear, when the invariant sequence of development is examined, that children's earlier errors are essential stages in the construction of the correct solution. To help children progress, therefore, the teacher must understand the reasoning processes which lead to these errors. Actually, in the case of Piaget's tasks, it is incorrect to say that children make "errors". For example, when they give a non-conserving answer by basing their judgment on the level of the liquid in the beaker, they are taking into account one of the factors that are indeed pertinent

to the judgment of quantities. This evaluation based on height is a step forward compared to judgment that is based on the color of the liquid or the attractiveness of the container. These pre-operational ways of thinking are not errors to be eliminated, but pre-logical modes of evaluation that have to be brought to the fore and integrated with other factors. Specific instruction can thus imply that the teacher should be a skillful questioner who asks just the right question at the right time to make the child figure out his own strategy at his own level.

Bereiter rightly pointed out that Kohlberg did not demonstrate why the invariant sequence should be the major issue in the determination of educational policy on cognitive development. The preceding discussion and what follows will hopefully explain why I believe that specific instruction should be based on the child's developmental stage.

Specific Instruction and Theories of Learning

Bereiter stated that "specific learning and cognitive stage development do not refer to different phenomena but rather to the same phenomena, described at different levels of generality and according to different principles." It will be argued below that specific learning and cognitive stage development are indeed two different phenomena, and that Bereiter's argument is based on a view of "learning" that differs rather basically from the Piagetian view.

Let us take the conservation of substance as an example of something that can be learned either by specific instruction or without any teaching. Bereiter and Kohlberg both discussed conservation in a narrow sense in isolation from the total structure that Piaget calls "intelligence".

In contrast, Piaget and Inhelder use the conservation task as a kind of thermometer to explore the structure and network of schemes that are inside the "black box". Conservation is thus not just conservation, but an indicator of an internal structure that has become coherent and reversible.

The conservation of substance is achieved shortly after the conservation of number. In other words, the latter indicates the beginning of reversibility of thought. About the time the conservation of substance is achieved, a host of other abilities also emerge--class inclusion, operational seriation, arithmetic operations, mental images that are mobile, geometric operations, a system of causal relationships in explaining physical phenomena, certain forms of language, etc., etc., etc., just to name a few that fill up many volumes. The common element in all these operations is thought that has become reversible, with the result that the child ceases to be dominated by the static, configurational aspect of what he sees. In other words, it is reversibility of thought that makes the operations possible.

It may be added, parenthetically, that if the above operations seem to appear and disappear at the beginning, as Bereiter pointed out, this is because reversibility of thought is a very gradual achievement, and fluctuation is a characteristic of the child who is at an intermediary stage of approaching the operational level.

Another point in Piaget's theory that is often overlooked is his belief that operations become stable only when they belong together. In fact, to speak of an isolated operation is a contradiction in terms, as an operation cannot exist in isolation. It is this integrated and

mobile system that Piaget calls "operational intelligence". Conservation which is achieved through specific instruction is, therefore, a phenomenon that differs from what is the result of the general structure that has become stable and reversible. The issue is neither one of "natural versus induced learning" as Kohlberg sees it, nor one of "rules of greater or lesser scope" as Bereiter sees it, but one of whether or not the operation in question is part of, or an outcome of, a larger whole.

If education is to aim at developing the total structure of intelligence, specific instruction would have to be combined with the more general methods of play, social interaction, and child-initiated learning that Kohlberg and the child developmentalists advocate. This combination could be either consecutive or simultaneous. The crucial question for specific instruction would then become "What kind of play in what kind of group, what kind of social interaction, and what kind of child-initiated learning?" Bereiter states that the Piagetian view and child developmentalist view may be "unrelated ones which merely happen to appeal to the same people." The two views seem to me to converge because Piaget provides a theoretical rationale for the traditional practices which have been defended merely on intuitive grounds.

The most questionable sentence in Bereiter's article may be the following: "If... a teacher is interested in educating young children so that they will become better thinkers in the long run, the last thing he need be concerned about is getting them to attain Piaget's stage of concrete operations, since he can be assured they will all reach it anyway without his help." The attainment of concrete operations indicates

that the child's intelligence has become more mobile and better structured so that he can now reason logically. The ramifications of this achievement are enormous (e.g., the ability to measure, to add and subtract, to multiply and divide, etc.), and if the child is two years behind in this achievement, he will theoretically have 2,000 hours of class time during which he will assume the role of a "slow learner" at least part of the time.

The above argument showed the relevance of the stage of concrete operations to early education from the standpoint of preventing learning problems. A second argument can be advanced from the point of view of the permanence of the acquisitions found in Piaget's tasks. A third argument can be based on what Piaget and Inhelder found recently about the nature of memory (Piaget & Inhelder, 1968; Inhelder, 1969). In these investigations, the authors found that what is learned in certain pre-operational situations is remembered not only permanently but also in such a way that the accuracy of memory improves over time through cognitive structuring. An example will be given below at the risk of grossly oversimplifying the findings.

In an experiment described in further detail in Inhelder (1969), the child was shown 10 seriated sticks (9-16.2 cm), and was told to take a good look at them in order to remember what he saw. A week later, and again 8 months later, the experimenter returned to the school and asked the child to recall what he had been shown. The memory was expressed with gestures on the desk and in drawings, and these were divided into several pre-operational sub-stages (e.g., (a) many lines all of equal length, (b) many lines of only two different lengths, (c) many lines of three different lengths, (d) lines of many different lengths but seriated imperfectly, etc.). Most of the pre-operational children's memory was

found to have improved toward the operational stage 8 months after the exposure compared to a week after it. (In other words, long-term memory was more accurate than short-term memory.) The book on memory gives additional evidence, both empirically and theoretically, to support the argument that when learning is rooted in the child's total cognitive organization, memory can be used as a powerful ally to produce long-term gains.

Finally, it must be pointed out that the above arguments are part of the broader issue of what different theorists mean by the term "learning". A thorough comparison of Bereiter and Piaget's views is beyond the scope of this paper, but a few differences can be mentioned. For Bereiter, the essence of learning seems to be the change in the child's behavior. For example, if the child can give conserving answers without being shaken by trick questions, he would conclude that conservation has been learned. His concern is whether or not the child can apply general rules to specific situations. Piaget is more concerned with how the internal processes become structured because rules that are not rooted in a total structure are not likely to lead to the construction of later structures.

We know very little about how exactly the pre-operational child learns. Nevertheless, the following three principles of learning can be selected from Piaget's theory for their relevance to preschool education:

1. Knowledge is not a copy of reality that is passively received but, rather, the result of an active construction on the part of the child.

2. Every concept the child possesses at a given time is related to the network of all the other concepts that he has built.
3. Assimilation and accommodation entail the necessity of the pre-operational child to go through one stage after another of reasoning "illogically" before he becomes able to reason logically.

The pedagogical implication of the above principles of learning seems to indicate that teaching must somehow take into account the pre-operational child's total cognitive structure even when the content and strategy of teaching are specific. This principle goes counter to Bereiter's philosophy of defining the specific criterion of learning in operational terms and setting out to reach the behavioral goals as efficiently as possible. The Piagetian objectives of instruction are broader, and the visible accomplishments come more slowly. Its approach can be criticized as being too unstructured and too idealistic to prepare the disadvantaged child for elementary school as it exists today. However, for the long-term benefit of the individual children as well as for the maximum development of society's human resources, I feel that the Piagetian approach is more defensible than Bereiter's.

In conclusion, Bereiter's view of specific instruction is not completely in disagreement with the Piagetian view. The two schools of thought converge with regard to the teaching of social knowledge, but not with regard to logico-mathematical knowledge. I have attempted to show above that logico-mathematical knowledge cannot be taught by empirical generalization and social reinforcement as if it were learned in the same way as social knowledge. The teaching of physical knowledge,

too, is a delicate art, since it is inextricably related with logico-mathematical structures.

The relative merit of the two approaches can be determined only through long-term longitudinal comparisons. The problem to guard against in such comparisons is that each school of thought has its own theoretical framework for evaluating "learning" as it defines its own goals of instruction. The solution to this problem is a continuous exchange of evaluators. Since the state of the art in evaluation is as primitive as it is in theories of instruction, the different schools of thought have much to learn from each other through the in-depth exchange of views, evaluators, and researchers for many years to come.

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FOOTNOTES

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